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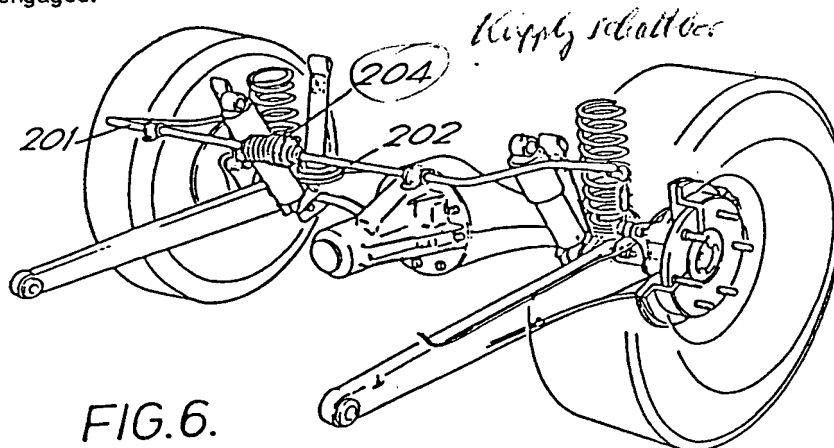
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(E1)

(54) Vehicle suspension system

(57) For use in a vehicle suspension system, an anti-roll bar device has two anti-roll bar portions 201, 202 with adjacent ends which can be coupled together against relative rotation by a clutch device 204 so as to function as a conventional anti-roll bar or be disconnected. The clutch can be operated to effect the connection selectively or when a low gear or four wheel drive is engaged.



*Klappenhebel Fig. 1*



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VEHICLE SUSPENSION SYSTEM  
DESCRIPTION

The invention relates to anti-roll or sway means for a vehicle suspension system and to such a system incorporating anti-roll or sway means.

The suspension systems of road vehicles, and more particularly vehicles intended for use either on or off the road, have to meet a wide range of requirements, in order to accommodate a variety of surfaces. For satisfactory performance under normal road conditions, a vehicle suspension system must possess a substantial degree of roll stiffness. Typically, this requirement is met by equipping the vehicle with a torsional anti-roll or sway bar, or bars, to enhance the roll stiffness provided by the suspension springs. However, for off-road use at low speeds a high degree of articulation in the suspension system is desirable, to allow adequate tyre/surface contact on extremely uneven surfaces, and to equalize the ground reaction of the vehicle wheels, insofar as this is possible.

The invention is accordingly provides a vehicle suspension system having means whereby the effect of an anti-roll or sway bar can be obtained selectively or in dependence on a predetermined condition. The invention can be carried into effect by the provision, in a suspension system which may be otherwise conventional, of an anti-roll bar which can be disconnected when required, so as to be rendered ineffective.

The invention thus also provides an anti-roll bar for use in a vehicle suspension system, the bar

comprising two portions and a releasable coupling, whereby the portions can be disconnected from each other or coupled together. In the disconnected condition, the two portions are free to turn  
5 independently, so the anti-roll bar is ineffective, but the portions can otherwise be coupled together positively so as to operate unitarily, in the manner of a conventional roll bar.

The coupling can advantageously take the form of a  
10 dog clutch, preferably engageable in only one angular position to avoid pretensioning of the anti-roll bar if it is re-connected when the vehicle is on an uneven surface. The coupling may be operated electrically, pneumatically or hydraulically and it is then  
15 preferably spring biased into the connected position. The spring loading constitutes a "fail safe" feature in that a fault condition that is, loss of power in the system, engages the coupling and so renders the anti-roll bar functional. A loss of roll stiffness could  
20 have a disadvantageous effect on vehicle stability at high speeds, whereas extra roll stiffness under off-road conditions at low speeds is likely to be merely inconvenient.

The condition of the anti-roll bar can be arranged  
25 to be controlled directly by the driver of the vehicle. Alternatively, the anti-roll bar can be arranged to be rendered ineffective as a consequence of the selection of a low gear ratio or four-wheel drive where the vehicle incorporates this facility.

30 The invention is further described below, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional side view of a coupling device incorporating a dog clutch for  
35 releasably connecting together two portions of an anti-

roll bar for a vehicle suspension system in accordance with the invention;

Figures 2A and 2B are respectively a sectional side view and a front view of a first clutch member of  
5 the dog clutch;

Figures 3 and 3A are respectively an end view and a cross-sectional side view of a second clutch member of the dog clutch;

Figure 4 is a cross-sectional side view of the  
10 member of the coupling which slidably supports the second clutch member;

Figure 5 is a perspective view of an independent front wheel suspension system incorporating a disconnectable anti-roll bar in accordance with the  
15 invention; and

Figure 6 is a perspective view of a rear axle suspension system again incorporating a disconnectable anti-roll bar in accordance with the invention.

The anti-roll bar of Figure 1 comprises first and  
20 second axially aligned portions 1 and 2 which can be connected together or disconnected from each other by a coupling device 4 incorporating a dog clutch. The anti-roll bar portions 1 and 2 are provided with means (not shown) to resist the axial loads imposed on the  
25 bar by the forces within the coupling device 4, for example, the means by which they are mounted to the vehicle structure.

The inner end, or left-hand end as shown, of the first anti-roll bar portion 1 extends through a sleeve  
30 portion of a first dog clutch or coupling member 7 and is secured to it by transverse pins 9. Slots 10 and projections 11 are formed at the end of the sleeve portion for the clutch member 7 adjacent the free end of the anti-roll bar portion, which is of reduced cross-  
35 section.

The free end of the outer or second anti-roll bar portion 2 is received in a hollow coupling member 15, to which it is secured again by transverse pins 9. The member 15 projects beyond the end of the bar portion 2 and receives within it the free end of the portion 1. A bearing 17 accommodates relative rotation between the portion 1 and the coupling member 15 when the dog clutch is disconnected.

External splines 19 on the coupling member 15 engage with internal splines 20 of the second dog clutch member 25 which is of annular form. At the left-hand end as shown, the second clutch member 25 has slots and projections shaped to co-operate with the slots 10 and projections 11 of the first clutch member 7. It will be noted that the slots and projections of the two dog clutch members 7 and 25 are such that clutch engagement can be effected in only one angular position of the two anti-roll bar portions 1 and 2.

A coiled compression spring 27 received around the coupling member 15 has its ends seated in a groove around a flange portion 29 of the coupling member and against a step formed within the clutch member 25, so as to act to urge the clutch member 25 into engagement with the clutch member 7.

A cylinder 30 extends from around the flange 29 of the coupling member 15 over the second clutch member 25 which makes a sliding fit within it. A port 31 through the cylinder wall communicates with a fluid pressure chamber formed between opposed steps in the cylinder wall and the second clutch member 25 and sealed by seals 32 and 34.

In the position illustrated in Figure 1, the first and second clutch members 7 and 25 are engaged, so the anti-roll bar portions 1 and 2 are connected together against relative rotation and function in the same way



as a conventional anti-roll bar. When desired by the driver of the vehicle, or in response to the driver's selection of a low gear, or of four-wheel drive, pressure fluid is supplied to the port 31 at a pressure  
5 sufficient to move the second clutch member 25, functioning as a piston within the cylinder 30, to the right as shown, with compression of the spring 27. This movement is limited by engagement of the clutch member 25 with the flange 29 of the coupling member 25,  
10 at which position the first and second clutch members are disengaged. The cylinder 30 is provided with a vent portion 35 preferably associated with a filter, to allow air to escape from between the second clutch member and the coupling member flange 29, and a gaiter  
15 36 extends from the cylinder to the first anti-roll bar portion 1 to protect the clutch members from moisture and dirt. The two anti-roll bar portions 1 and 2 thus are free to rotate independently of one another on the bearing 17 and are thus ineffective of one another on  
20 the bearing 17 and are thus ineffective to stiffen a suspension system in which they are incorporated.

This position is maintained until the fluid pressure applied to the port 31 is released, when the spring 27 moves the second clutch member 27 to re-  
25 engage with the first clutch member in the position shown in Figure 1.

Anti-roll bars embodying the invention can be incorporated into vehicle suspension systems of any appropriate kind. Figure 5 shows an independent front  
30 wheel suspension system incorporating an anti-roll bar in accordance with the invention comprising portions 101 and 102, of which the latter is shown supported by a bracket 103 on the vehicle frame or chassis, the two portions being releasably connected by a coupling 104,  
35 which can correspond to the coupling 4 of Figure 1.

Figure 6 shows an anti-roll bar according to the invention incorporated in a rear axle suspension system, the anti-roll bar comprising portions 201 and 202 releasably connected together by a coupling 204 which can again correspond to the coupling 4 of Figure 1.

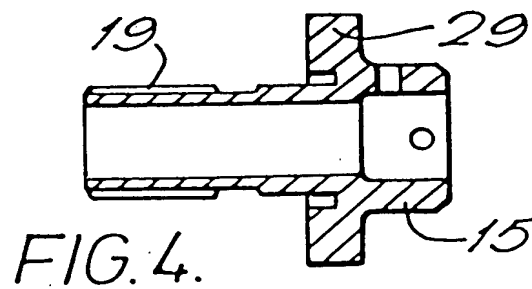
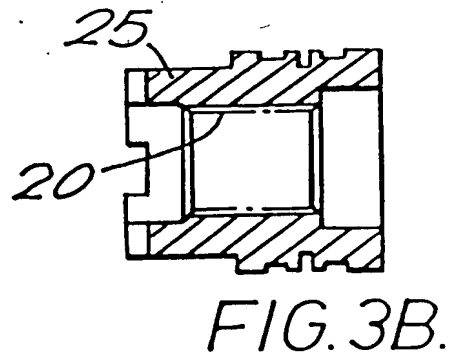
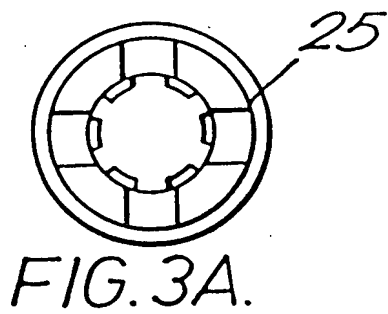
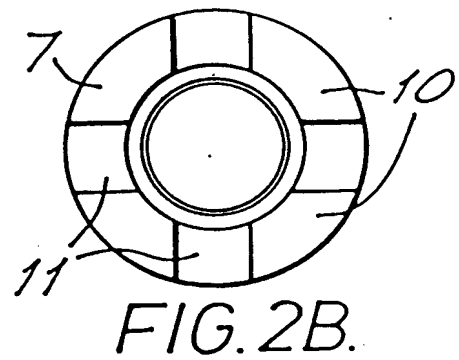
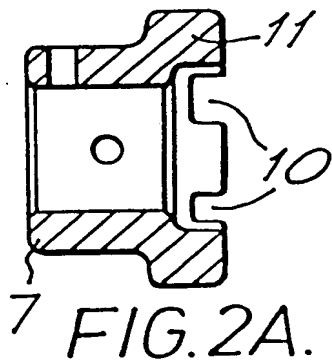
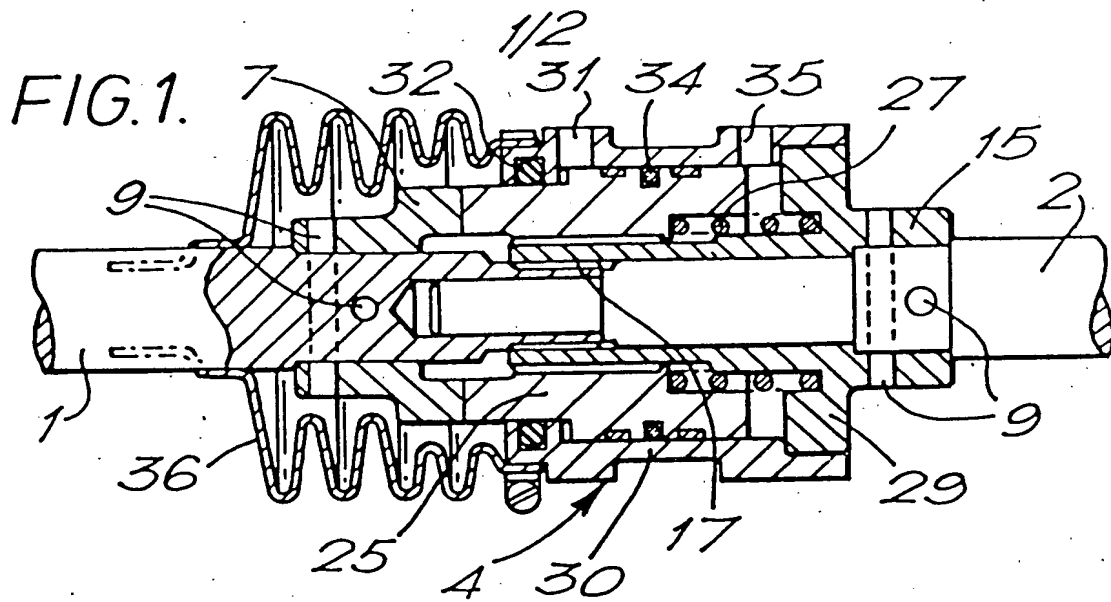
The invention can of course be embodied in a variety of ways other than as specifically described and shown. For example, the coupling could be electrically engaged and disengaged.

CLAIMS

1. An anti-roll bar device comprising first and second anti-roll bar portions (1,2), a clutch device (4) for releasably connecting together adjacent aligned  
5 ends of the anti-roll bar portions, and actuator means (27,29-31) for moving the clutch device between its engaged and disengaged conditions.
2. An anti-roll bar device as claimed in claim 1 wherein the actuator means comprises a spring (27)  
10 biasing the clutch device (4) into its engaged condition and fluid pressure means (29-31) operable to move the clutch to its disengaged condition against the bias of the spring.
3. An anti-roll bar device as claimed in claim 1  
15 wherein the clutch device comprises a first clutch member (7) fixed to the first anti-roll bar portion (1), and a second clutch member (25) non-rotatably carried by the second anti-roll bar portion (2) for movement axially into and out of engagement with the  
20 first clutch member.
4. An anti-roll bar device as claimed in claim 3 wherein a spring (27) acts on the second clutch member (25) to urge it into engagement with the first clutch member (7) and the second clutch member (25)  
25 constitutes a piston movable in a cylinder (30) whereby it can be exposed to fluid pressure to move it out of such engagement.
5. An anti-roll bar device as claimed in claim 1, 2, 3 or 4 wherein the clutch device (4) can reach its  
30 engaged condition in only one angular position of the anti-roll bar portions (1,2).
6. A vehicle suspension system comprising means (1,2,4) providing different degrees of anti-roll stiffness selectively or in dependence on a second  
35 vehicle condition.

7. A vehicle suspension system as claimed in claim 6 wherein the means providing the anti-roll stiffness comprises an anti-roll bar device as claimed in any one of claims 1-5.

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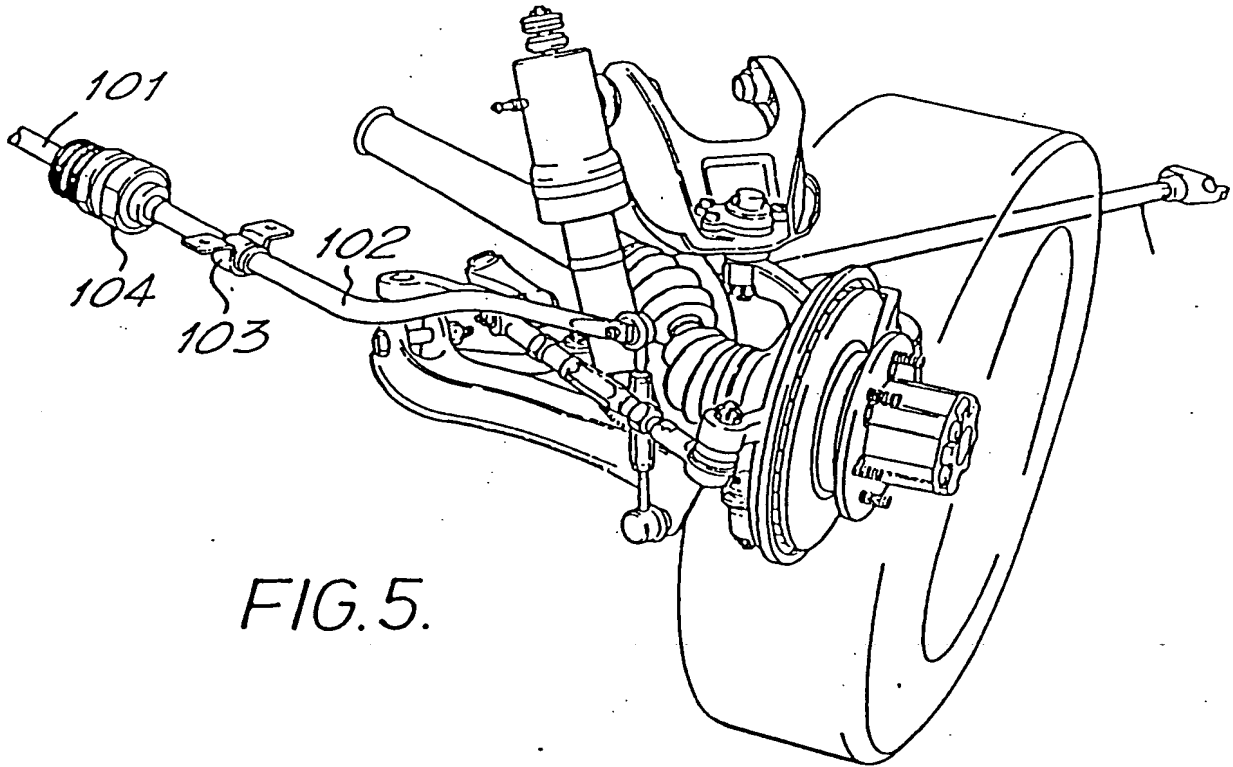


FIG. 5.

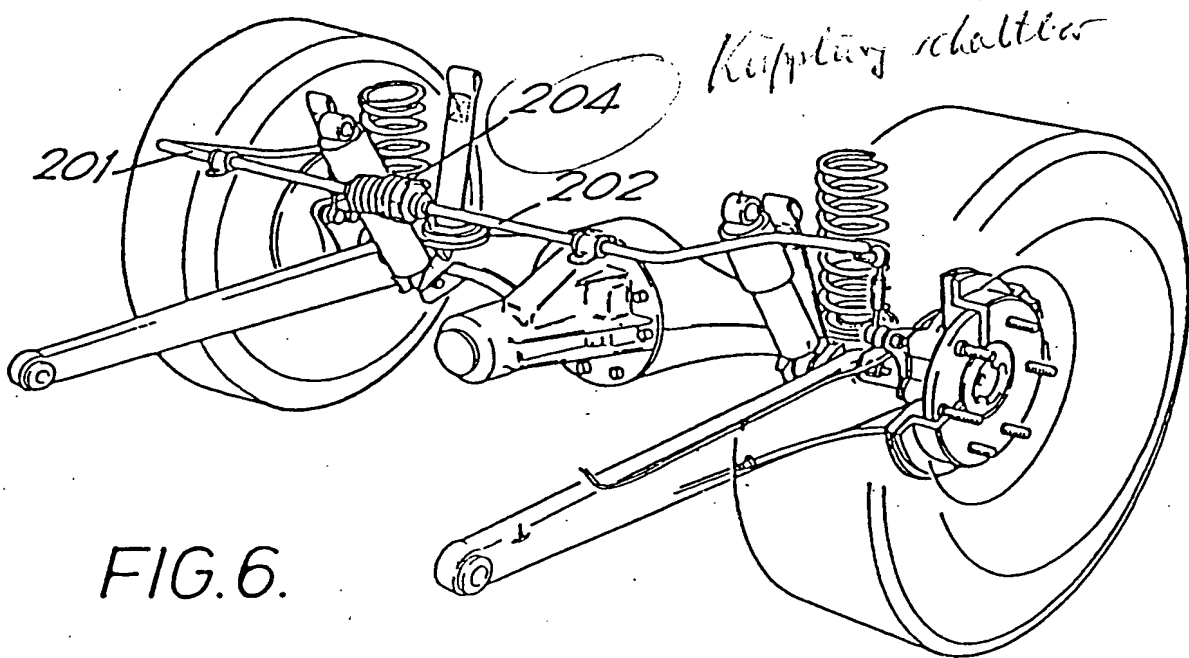


FIG. 6.